

# Bridge

This Newsletter aims to promote communication between schools  
and the Student Health Service of the Department of Health

September 2015 Issue No.68

Published by the Student Health Service, Department of Health

## Editorial

The structure of our ears is very complicated. It can be divided into three parts. They are the external, middle and inner ear. The middle ear is between the inner and external ear. If the condition of middle ear gets worse, it can affect our health and cause complications. In this edition, we introduced the structures and functions of the middle ears, the common health problems occurred in the middle ears and the way to protect the ears. We hope that these information can help us to protect and safeguard our hearing.

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# Middle Ear and its Problems



Audiologist: Mr HO Chi-tak

When we look into the external auditory canal (ear canal), the middle ear is the air-filled space located behind the eardrum. It connects the outer and inner ear structures. Since the middle ear is located deep in the head, it seldom attracts attention. The middle ear is easily affected the problems in the upper respiratory tract as it is connected with the nasopharynx (the upper part of the throat behind the nose). Middle ear disease may lead to serious complications as it is adjacent to the important parts in the head. The article will discuss about the cause and prevention of the common middle ear problems such as otitis media.

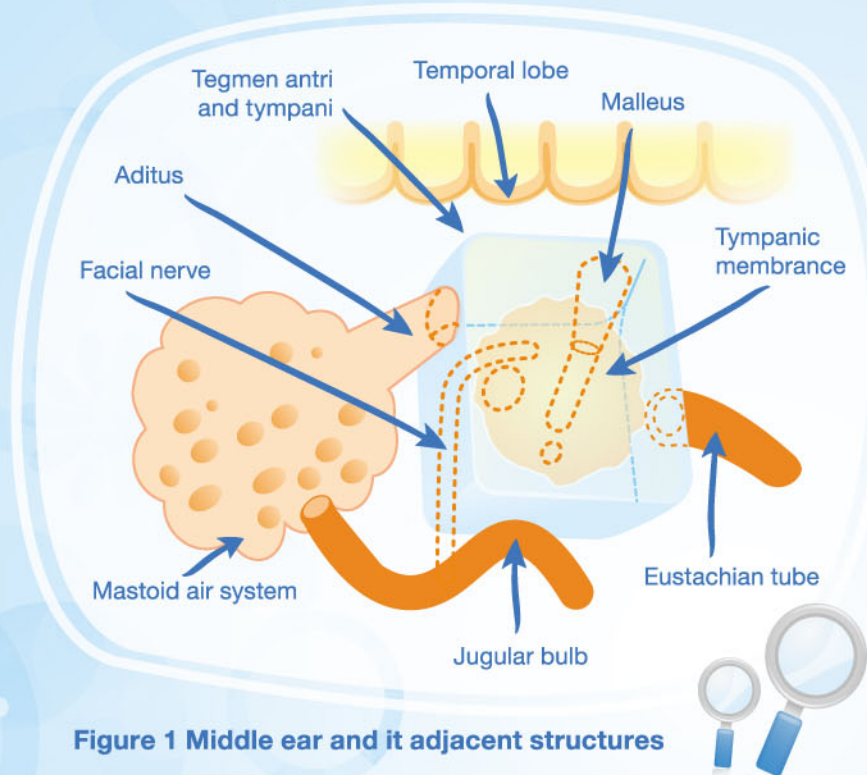


Figure 1 Middle ear and it adjacent structures

## Important Structures Adjacent to Middle ear

- **Outer wall:** tympanic membrane (commonly known as eardrum)
- **Medial wall:** the outer wall of the inner ear, adjacent to the cochlea, vestibular (balance organs) and facial nerve channels.
- **Front wall:** the entrance of Eustachian tube located at the bottom connects the middle ear with the nasopharynx.
- **Rear wall:** there is a gas channel called aditus at the top. It leads to a series of gas chambers called mastoid air cells which are located at the lower part of the skull.
- **Ceiling:** there is layer of bone known as tympanic tegmen, adjacent to the middle cranial fossa dura and other cranial structures
- **Flat:** the two important blood vessels (internal carotid artery and jugular bulb) are located beneath the bony flat of middle ear.

## The Structure and Function of the Middle Ear

Middle ear is an air-filled space surrounded by mucosa and it is located in the petrous part of temporal bone (a part of the skull bone). The most well-known structures are: tympanic membrane, ossicular chain and Eustachian tube:

### 1 Eardrum and Ossicular Chain: sound conduction and regulation

Sound vibration collected by the outer ear is transmitted to the oval window of the cochlea by the eardrum and the ossicular chain (consists of three ossicles: malleus, incus, stapes) connected to it. This results in vibrations of fluid within the cochlea and hearing sensation arise. This lever system amplifies the sound vibration and makes very soft sound audible. Middle ear muscles are connected with some of the ossicles. When the incoming sound is very loud, the ratio of sound transmitted by the lever system will be reduced by neural reflexes of the muscles in order to protect the inner ear from damage.

### 2 Eustachian tube: regulating the pressure in the middle ear

Eustachian tube is the pipeline connecting the ear (middle ear) and throat (nasopharynx and rear side of nasal cavity). Its main functions are:

- regulate the pressure in the middle ear, equalize the pressure difference between outer ear and middle ear;
- drain the secretion from the middle ear cavity to the nasopharynx;
- ventilate the middle ear cavity with fresh air from the nasopharynx.

However, the Eustachian tube is the major gateway that the middle ear gets infection.

The Eustachian tubes of babies and children are shorter and flatter than those of adults, and their diameters are relatively wider. These make children get otitis media more easily than adults. The structure of the Eustachian tube will mature gradually when children are approaching age of eight. Their middle ear function will also improve gradually.



# Middle Ear Dysfunction



In normal circumstance, the Eustachian tube can be opened and closed intermittently. Either patent or blocked Eustachian tube can be considered as abnormal.

## 1 Patent Eustachian tube

Middle ear connects with the nasopharynx non-stop. People affected will be able to "hear their own breathing." The major causes include:

- sudden loss of weight (e.g. post-natal) or
- intake of certain medications (such as antihistamines, birth control pills, etc.).

This situation rarely occurs. This can be solved by leaning your head down, or lie down after a few minutes.



## 2 Blockage of Eustachian tube

When the Eustachian tube failed to open, middle ear pressure will decrease continuously. People affected may have a sense of ear blockage, or even earache and tinnitus. The common causes for this condition:

- allergic rhinitis (allergy of the nose), upper respiratory tract infections (colds and sinusitis) result in swelling and inflammation of the Eustachian tube
- swelling of tissue adjacent to nasopharynx such as enlarged adenoid (gland-like lymph tissue)
- rapid pressure changes caused by air traveling or diving
- sudden weight gain (e.g. pregnancy, decreased thyroid function)
- developmental defect in Eustachian tube, as in Down syndrome
- malfunction of soft palate that responsible for Eustachian tube opening, as in cleft palate
- nasopharyngeal cancer.

Prolong Eustachian tube blockage will cause negative middle ear pressure, which retracts the eardrum. Middle ear fluid may build up and result in a higher risk of acute otitis media. Accumulation of fluid in the middle ear makes the eardrum immobile and damped the vibration of the lever system (eardrum and ossicles). This would result in temporary conductive hearing loss. If the obstruction continues without treatment, this may sometimes cause chronic otitis media or cholesteatoma (abnormal cyst) which may damage the ossicles.



## Solutions

- ✦ Get rid of the illnesses which cause the blockage such as allergic rhinitis, colds or sinusitis.
- ✦ When blowing your nose, pressed against one side of the nose, gently blow out from the other side, and then swap sides. This may prevent the infectious secretion in nose and nasopharynx from entering the middle ear via the Eustachian tube.
- ✦ Keep your home clean in order to reduce irritation of the respiratory tract by dust and do not smoke in front of children.
- ✦ Consult your doctor to see if medication could ease the Eustachian tube blockage.
- ✦ While feeling ear blockage, try these to make the Eustachian tube open: chewing gum, blowing balloons and swallowing.
- ✦ For parents with children that have hearing problems or symptoms of ear disease, consult your health care professional for early treatment to prevent the problems getting worse.





# Common Middle Ear Diseases associated with Eustachian tube Blockage



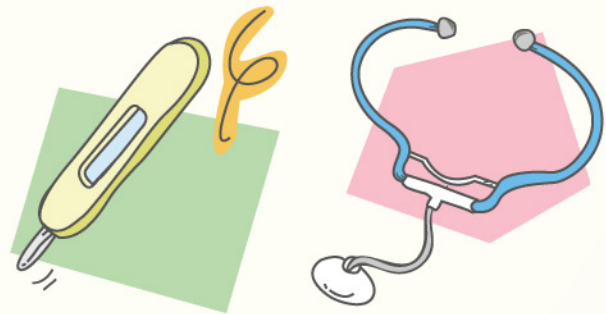
## 1 Acute Otitis Media

"William is four years old, he have been suffering from a cold for three to four days. At midnight, he had sudden fever and severe earache. The Ear-Nose-Throat (ENT) doctor saw that the eardrum with otoscope (an instrument) and found William's eardrum red and bulging outward. These might be signs of acute otitis media."

Young children are more likely to have acute otitis media than adults as their immune systems are less mature. Also, the Eustachian tubes of children under 7 years of age are shorter than those of adults. When children suffer from upper respiratory tract infections, germs in the nasopharynx can easily enter the middle ear cavity via the Eustachian tube and cause infection.

Common symptoms of acute otitis media:

- severe earache
- fever
- the middle ear effusion causing feeling of blockage and hearing loss
- symptoms of rhinitis
- if eardrum ruptured, pus will come out of the external auditory canal



In general, acute otitis media requires antibiotic treatment, allergy medications or nasal spray. Doctors may also prescribe medication to relieve allergy, fever and pain. Patients should follow medical instructions for medication especially completing the whole course of antibiotics. Antibiotics may relieve earache in a short time, but it takes longer to get rid of the infection. Not completing the course of antibiotic treatment may result in breeding drug-resistant bacteria.

If the patient suffers from serious earache or likely to have complications of acute otitis media, the doctor may pierce a small hole on the eardrum to drain the middle ear fluid and to relieve discomfort. Such small hole would usually heal within a few days, and this will not cause damage or leave obvious scars on the eardrum. Even if the acute otitis media has subsided, the middle ear fluid may still affect sound conduction and cause short-term hearing loss. Generally, it would return to normal within four to six weeks. If hearing does not improve, it may be necessary to pierce the eardrum or instill a grommet on the eardrum. This helps to accelerate the recovery of middle ear by draining the fluid and ventilating the middle ear. Otitis media may be caused by chronic infection in adenoids and tonsils (lymph tissue mass). For cases with recurrent otitis media, the doctor may propose removal of adenoids and tonsils during the operation for grommet insertion.

Children are prone to acute otitis media in the autumn and winter. Second hand smoking and air pollution will increase the risk for otitis media. Children and adolescents with cleft palate and Down syndrome are prone to otitis media due to the dysfunction of their Eustachian tube. The most common bacteria causing acute otitis media are: *Streptococcus pneumoniae*, *Haemophilus influenza* bacteria, *Moraxella catarrhalis* type monocytogenes. *Streptococcus pneumoniae* accounted for about half of the cases in acute otitis media, pneumococcal vaccine injection can reduce the risk of otitis media. Influenza vaccine can reduce otitis media secondary to influenza.



# Common Middle Ear Diseases associated with Eustachian tube Blockage



## 2 Middle Ear Effusion

"Jack is now 6.5 years old and he has allergic rhinitis. He feels that his ears are blocked during autumn and winter or when he has a cold. His doctor finds that Jack's external auditory canals are dry and clean. There is no ear wax nor other problems except that the eardrums which should normally be bright and clear become dull and reddish. It seems that Jack is having otitis media with effusion."

Middle ear effusion is the accumulation of fluid in middle ear cavity without acute inflammation or infection. The is common among children between age two to six children. Most of them will recover naturally without treatment within two to four months. Middle ear effusion is difficult to detect when symptoms are mild, with occasional ear and ear swelling feeling. In some cases, the effusion and blockage continue and may result in mild to moderate conductive hearing loss. Permanent damage in eardrum and ossicles may occur in some of the serious cases.

As long as the Eustachian tube is open, the fluid can be drained gradually. Sometimes this can be facilitated by medication such as anti-allergy drug and steroid nasal spray. If the middle ear effusion continues, doctors may consider piercing the eardrum and inserting grommets to drain the effusion in order to prevent further complications.

If children have allergic nose, history of hearing loss, nasal congestion, snoring, history of tonsillitis and history of acute otitis media within a year, their risk for excessive middle ear effusion is relatively high. Among these, the risks for nasal congestion, history of acute tonsillitis and history of acute otitis media are considered as the highest.

## 3 Air Travel and Otitis Media

During taking-off and landing of aircraft, there will be a large difference between the air pressure in the cabinet and the air pressure in the middle ear. Such pressure gap may easily cause Eustachian tube obstruction among:

- children whose Eustachian tubes are short and flat and;
- those who are suffering from swollen tonsils and adenoids because of flu.

Precautions:

- Before air travel, see the doctor to settle nasal congestion, colds and flu. Use prescribed medication to relieve nasal congestion during the flight, if needed.
- Babies are prone to otitis media related to air travel. Sucking a pacifier or bottle while the aircraft is taking-off and landing help to keep their Eustachian tube open.
- Balance middle ear air pressure by gum chewing, swallowing and yawning while the aircraft is taking-off and landing.
- Do not sneeze hard or pinch the nose firmly to blow hard during the flight. This would force the nasal secretion into the middle ear cavity and cause otitis media.



## 4 Perforated Eardrum

Small perforation on eardrum will not affect hearing significantly. If the perforation is large, the hearing will be impaired. Without proper care, a perforated eardrum will be infected, and result in otitis media causing ear discharge and pain. These may sometimes damage the middle ear ossicles and the auditory nerve, and if worsen cause hearing loss.

In case of eardrum perforation, the external auditory canal should be kept clean and dry. Safety measures should be taken to avoid water from entering middle ear.

- Stop swimming and diving.
- While shampooing, put cotton balls in the entrance of external ear canal to prevent water from entering.
- Symptoms of infection such as discharge arises, instill medicated ear drop according to your doctors' advice.

In general, perforated eardrum will heal natural in ten days under proper care. If perforation has not healed after a long period of care, surgery for eardrum repair may be considered.



# Common Middle Ear Diseases associated with Eustachian tube Blockage



## 5 Chronic Suppurative Otitis Media

When the eardrum perforates (no matter the reason), bacteria can easily enter the middle ear cavity. This leads to a long-term inflammation of the middle ear, and “glue-like” secretion may be discharged to the external auditory canal. Due to improved public health standards and effective antibiotic treatment of acute otitis media, there is a significant drop in occurrence of chronic otitis media in recent years. Surgery for eardrum repair is possible, if the middle ear cavity is free from inflammation and the ear canal is dry and clean after antibiotic treatment. Repairing eardrum can help to reduce inflammation of the middle ear and improve hearing.

## 6 Cholesteatoma

Cholesteatoma is not a real tumor but a form of chronic middle ear disease which is closely related to chronic otitis media. As the eardrum is perforated due to long-standing inflammation of the middle ear, the skin of the external ear canal migrates into the middle ear through the perforation and finally reach the mastoid air rooms at the back of the middle ear. The skin debris grow drastically, eroding the surrounding bone and then make it into a hollow cavity. Pathogens including bacteria breed in the middle ear and mastoid and produce secretions with odor. They further erode the surrounding bony structure and spread the infection.

Cholesteatoma is very dangerous as it will slowly erode the structures around the middle ear and the inner ear, and even spread to the structures of the head, affecting the facial nerve, brain and major blood vessels that may lead to serious deafness, dizziness, facial paralysis, meningitis and brain abscess and other serious complications. Most cases require surgery, and prompt treatment is essential to prevent complications. These patients require long-term and regular medical follow-up, even after the surgery.

## Conclusion

Healthy middle ear is crucial to good hearing. As the middle ear is connected with the nasopharynx, it is susceptible to influence from the upper respiratory tract. There are important structures in the head adjacent to middle ear, therefore middle ear disease may lead to serious complications. Eustachian tubes are immature in children under age of seven, their middle ears are more easily infected by nasal secretion coming through the nasopharynx. If the child suffers from allergic rhinitis, sinusitis and other respiratory diseases, parent should pay attention to the child's hearing. If parents noticed any signs of ear disease or hearing problems in their children, they should consult their doctor as soon as possible. Early treatment can prevent the problem from getting worse.

Student Health Service, Department of Health, provides hearing screening services for all primary one students (or any other who take part in a health check for the first time), secondary two students and those who have concerns about their hearing. Parents who suspect their children to have hearing problems may consult the medical staff at the time of the regular health check-up.

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## Bridge Blog

### I will protect hearing by.....

- ✓ Don't turn on the music too loud
- ✓ Avoid staying in a noisy environment for too long
- ✓ Don't pick the ears with cotton buds
- ✓ Cover the ears when exposed to loud noise
- ✓ Don't speak loudly next to other's ears
- ✓ Adjust the television volume to suitable level
- ✓ Don't prolong the use of earphones to lower the chance of hearing problems



## Bridge Chat



Ying

It's fun to travel on a plane.

I don't think so! Recently, I got ear pain every time during take-off and landing. It's uncomfortable.



Fong



Ying

It may be related to air pressure. I suggest you visit your doctor to treat the ear, nose and throat problems first before getting on the plane. You could also bring some chewing gums. Chewing gum can help to balance air pressure in the middle ear. This will reduce the ear pain.

Thank you for your suggestion.



Fong



Ying

Hope you will enjoy your trip!

# Junior Health Pioneer

Junior Health Pioneer (wearing sun protection swimming suit, holding a swimming board and looking very excited) asking Scarlet to go to swimming class together.

Scarlet, Why did you miss your swimming class last week?



I got flu, fever and left ear pain last week. The doctor said I got acute otitis media with a hole of the eardrum.



The doctor advised me to stop swimming and avoid water getting into my ears for the time being.



Take more rest!  
Let's go to swimming class after you get well!



For enquiries of student's health problem, please send e-mail to "Health Box".

Email Address: [shsbridge@dh.gov.hk](mailto:shsbridge@dh.gov.hk)